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# Role of Composite Bone Graft Versus Autograft for Bridging Bone Defect


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**ABSTRACT**

*Introduction : In literature, autograft is quite helpful in cases of non union, mal-union, bone tumours and pathological fractures but it is associated with donor site morbidity and is not available in large quantities to bridge the large defect so aim of the study is to compare outcomes of composite bone graft and autografts in patients with non-union, mal-union, bone tumour, pathological fractures. Methods: It was a prospective study in which total 50 patients were included. In 25 patients composite bone graft was used and in another 25 patients autograft was used along with internal or external fixation. Composite bone graft was prepared using hydroxyapatite, tri-calcium phosphate and bone marrow. Patients were divided in two groups. Group A had 14 males and 11 females and Group B had 16 males and 9 females . Results: Results were evaluated using un-paired T test. tcalc = 1.743 ≥ ttab = 1.684. Discussion : Composite bone grafts is important addition in the armamentarium for surgical treatment of pathological fractures, traumatic bone loss and in cases where fusion is required with no donor site morbidity.*


**KEYWORDS : Composite Bone graft; Autograft; Hydoxyapatite; Tri-calcium Phosphate.**

**Introduction:**

Composite bone grafting consists of combination of osteo-conductive matrix and bio-active agents that provides osteo-inductive and osteogenic properties. Thus the osteo-conductive substrate becomes a delivery system for bio-active agents, which increases chemotaxis and increases migration of osteoblasts progenitor cells to graft site. Autologous bone graft remains the gold standard as its capability for osteoconduction and osteoinduction combined with the presence of osteogenic cells make it highly effective[1]. Unfortunatley, autologous graft is associated with donor site morbidity, additional procedures leading to increased operative time, and patient-related variables such as inconsistent volume and quality of graft [2-3]. Recent studies have demonstrated calcium phosphate cements may be an acceptable alternative and provide excellent structural properties [4-5]. However, because of slow resorption or replacement of calcium phosphates may be problematic if they migrate into the joint space or in case of infection [4,6]. Additional alternatives include calcium phosphate cements, hydroxyapatite and demineralised bone matrix {DBM} [1, 6, 7, 8, 9, 10-16]

**Materials and Methods:**

This was a prospective study of 50 patients conducted in DR.D.Y. Patil medical college and research centre, Pune during July 2013-Novemeber 2014. Patients were randomly distributed in two groups. Patients in group A were treated with autograft with internal or external fixation. Patients in group B were treated with composite bone graft with internal or external fixator. Group B patients were treated with composite bone graft containing mixture of hydroxyapatite, tri calcium phosphate and bone marrow with proper fixation for stability at defect site. Bone marrow was taken from iliac crest intra-operatively by bone marrow aspiration needle percutaneously and added to TCP and HA. Group A had 14 males and 11 females. Group B had 16 males and 9 females. Both groups had age range of 11 years to 60 years with mean age in group A was 35 years and group B was 38 years. Group A had 10 cases of non-union whereas group B had 7 cases. Group A had 3 cases of bone tumour whereas group B had 5 cases. Group A had 7 cases of pathological fractures where as group B had 5 cases. Group A had 9 cases of mal-union and Group B had 4 cases.

**figure 1 : Synthetic Bone Graft**

**figure 2 : Autograft**

**figure 3 : Autogenous bone graft site**

**figure 4 : Distal tibia malunited fracture treated with Distal medial locking plate and composite bone graft**

**figure 5 : Distal End Radius Malunited fracture treated with volar locking plate and composite bone graft**

**Results:**

In our study we had used bone graft in 10 cases of non-union and in all cases radiological union was achieved in 18-20 weeks. Out of 8 cases of bone tumour 4 cases were treated with bone graft and all showed radiological union in 16-20 weeks. Out of 12 cases of pathological fractures 6 were treated with bone graft and all of them showed radiological Union in 18-21 weeks. Out of 13 cases of mal-union 5 cases were treated with bone graft and all of them showed radiological union in 18-20 weeks. In our study of 50 cases 4 got infections in post-operative period. The cause of infection was investigated and it was found that the graft was not the cause of infection as we had achieved good union at the grafted site within the average period of 20 weeks. All infections were controlled by proper anti-biotic therapy given after culture sensitivity test. There was no gaping of wound in any case. Only serous discharge was found in few cases which were controlled after anti-biotic therapy and dressings. There was no growth of organisms in any culture report. There was on average increase of 20 minutes in surgical time where autograft was used in similar surgeries.

| Group | Male | Female |
|---|---|---|
| Group A | 14 | 11 |
| Group B | 16 | 9 |

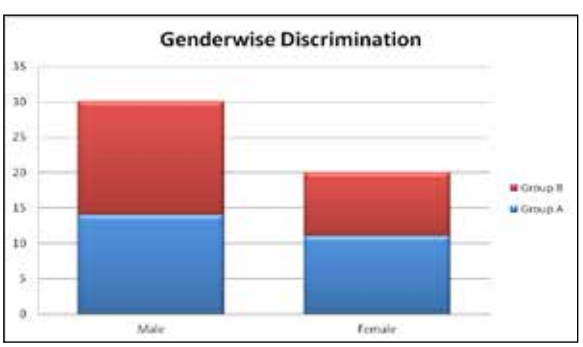
| Group | Range | Mean Age |
|---|---|---|
| Group A | 11-60 | 35 |
| Group B | 11-60 | 38 |

| Group | Non-Union | Mal-Union | Bone Tumour | Pathological Fractures |
|---|---|---|---|---|
| Group A | 10 | 09 | 03 | 07 |
| Group B | 07 | 04 | 05 | 05 |

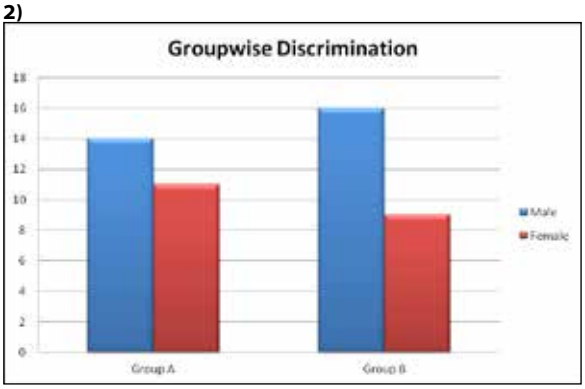
| Group | Union Time |
|---|---|
| Group A | 21 weeks |
| Group B | 20 weeks |

**Graphical Representation Of Data**

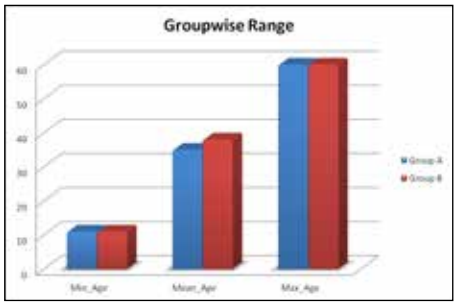
**1)**



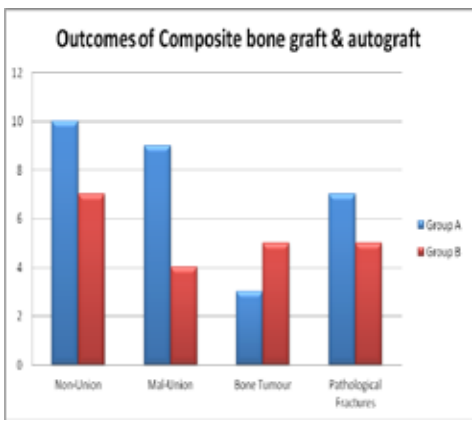

**2)**



**3)**




**4)**




**Statistical Analysis of data**

95% confidence interval for Equality of means using t-statistics is given as,

$(\mu - 1.96\sigma, \mu + 1.96\sigma)$*

It is known that the population variance can be estimated as 2.093 which give 95% confidence interval (-6.185, 2.025)

The level of significance, $\alpha = 0.05$

$H_0: \mu_1 \neq \mu_2$

Against $H_0: \mu_1 = \mu_2$

The calculated value of t-statistic is

$t_{calc} = 1.743$ with 48 degrees of freedom.

$t_{tab} = 1.684$ (for 48, 0.05)

According to p value is insignificant so there is no significant difference between the outcomes of both groups with respect to radiological union of fracture.

*Overlapping Confidence Intervals and Statistical Significance (October 2008)

**Discussion:**

Autologous bone graft is recognized superior to allograft and composite bone graft and is always preferred. Autograft is having osteoconductive, osteoinductive and osteogenic properties [1]. Autologous bone grafting remains the gold standard for fractures, non-union, pathological fractures [17-20] .

In our study we used autograft in 25 cases with successful fusion in all cases.

Tri-calcium phosphate:-Calcium phosphates are generally considered the materials of choice to be used as artificial bone substitutes. Several calcium phosphate ceramics are biocompatible and most of them are resorbable, dissolving in physiological environment [21]. They have long been used in bone repair, since, structured as porous, they mimic both the bone structure and chemistry. Cameron et al. (1977) [21] demonstrated that TCP ceramic implants placed on intact living bone cortex did not show any bone in growth but were resorbed over time. But when placed subperiosteally and in tight contact with the host bone, bone in growth took place. Traditional calcium phosphates used in medicine are HA, TCP, and HA/TCP composites (=biphasic calcium phosphates, BCP) (Bohner 2001) [22].

McDavid et al. (1979) [23] with the millipore chamber techniques showed that TCP implants formed bone only in the presence of bone marrow, i.e. the implants were not osteoinductive. We used osteo-induction properties of bone marrow along with osteo-conductive property of tri-calcium phosphate to enhance bone defect in host bone.

Vaccaro et al (2002)[2] and Arrington ED et al. (1996)[3] concluded that although autologous bone graft was efficient in treatment of fractures with bone loss but was associated with donor site morbidity and was also associated with increased operative time and patient related variables like quantity and quality of graft.

**Conclusion:**

Composite bone grafts is important addition in the armamentarium for surgical treatment of pathological fractures, traumatic bone loss and in cases where fusion is required with no donor site morbidity. There is no constraint for the quantity of graft in composite bone graft as compared to autologous bone graft.

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